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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/595,778	06/16/2000	Michael Grimbergen	AMAT/2077.D1	6490

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EXAMINER	
OLSEN, ALLAN W	
ART UNIT	**PAPER NUMBER**
1763	
MAIL DATE	**DELIVERY MODE**
09/19/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	09/595,778	GRIMBERGEN ET AL.	
	Examiner	Art Unit	
	Allan Olsen	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 June 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10,12-22,24,25,33-45,56-86 and 89* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,12-22,24,25,33-45,56-86 and 89* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-7, 10, 12-22, 33-45, 56-86 and 89 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,985,092 issued to Chiu et al. (hereinafter, Chiu) in view of U.S. Patent 5,961,850 issued to Satou et al. (hereinafter, Satou).

Chiu teaches monitoring ICP plasma etching processes with an optical fiber inserted between the coils of the inductive plasma source antenna. Chiu teaches energizing a plasma gas by applying an RF current through a multi-turn antenna above an external surface of a wall of the process chamber to pass RF energy through the external surface of the wall of the process chamber to couple the RF energy to the gas inside the process chamber to energize the gas; detecting radiation from directly above the surface of the substrate after the radiation propagates through the wall and the external surface of the process chamber; and evaluating the detected radiation to monitor the depth of a layer being processed on the substrate. Chiu teaches using a lens in association with the optical fiber thereby Chiu teaches collimating the radiation.

The following excerpts are some the most relevant passages of Chiu.

Column 2, lines 10-17

> Ellipsometric measurements are used to detect the thickness of films deposited onto workpieces and might be used to monitor the etching of thin, relatively uniform films. Reflectance measurements including reflectance spectroscopy can be used to detect the presence or absence of a film on the surface of a workpiece and so might be used for detecting the deposition of a film or removal of a film in an etching process. Each of these techniques could be used in an endpoint detection system

Column 2, lines 28-50

While some of the processing chamber walls are formed from transparent materials such as quartz, it may be necessary to provide transparent windows through the chamber walls when optical monitoring is to be performed through walls that are not transparent. It may also be necessary to provide an optical path or viewing port through structures that are provided around the processing chamber. For example, in some plasma etching systems, the etching chamber is contained within electrical coils that are used for applying either a radio frequency (RF) electric field or a magnetic field to the interior of the etching chamber. An example of such a system is the Hitachi 308-ATE ECR Metal Etcher, which provides coils formed of hollow copper tubing around the quartz walls of the etching chamber. The copper coils are provided around the etching chamber to provide an RF field to the interior of the chamber, and completely surround parts of the chamber walls. To implement an endpoint detection system for this metal etcher, it is most convenient to provide an optical fiber through the coils to a fixed position adjacent the quartz chamber wall so that the fiber images at least a portion of the etching chamber. Sensing operations can then be performed through the optical fiber to facilitate operation of an endpoint detection system.

Column 2, lines 59-63

An outer chamber having an outer chamber wall at least partially encloses the etching chamber and has an optical access port provided in the outer chamber wall. The optical access port includes a mounting structure for holding an optical element in fixed relationship to the inner chamber wall and the outer chamber wall.

Column 3, lines 46-50

A particularly useful configuration of an endpoint detection system includes an optical fiber that images a portion of the etching chamber and acts as an optical probe for monitoring the etching process.

Column 4, lines 5-12

The optical fiber probe of the endpoint detection system passes through the containment wall and the end of the optical fiber is held in a fixed position adjacent the wall of the etching chamber by a mounting system attached to the containment system wall. Generally, a sleeve is provided around the optical fiber which passes through the containment walls and between the coils to protect the fiber from the coils. Many times, the entire length of the optical fiber is enclosed within a sleeve.

Column 5, lines 50-61(with emphasis added)

The end of the **optical fiber 26 is positioned** so that the optical fiber images a portion of the etching chamber, **typically above the surface of wafer** 16. It may be desirable to provide a lens or other optical elements in association with the end of the optical fiber to collect light to improve the efficiency of the endpoint detection system. Such optical elements would typically be mounted on the inner containment wall 20. The optical signal collected through the etching chamber wall 12 from the interior 10 of the etching chamber passes through the optical fiber 26 and is provided to optical detectors and signal processing circuitry within the endpoint detection system 28.

Chiu does not explicitly teach detecting radiation from directly above the substrate with the particular coil configuration being claimed.

Satou teaches ICP plasma reactors having the claimed coil configurations (see figures 5 and 7).

It would have been obvious to one skilled in the art to use Chiu's detection method with the ICP plasma apparatus taught by Satou because Chiu's method is generally applicable to ICP plasma apparatus (see column 2, lines 34-50; column 4, lines 28-30; and column 7, lines 20-36).

Regarding the limitations pertaining to directing or detecting radiation from "directly above" the substrate, the examiner notes that "directly above" is broadly interpreted to mean "above" (see discussion Response to Arguments). Furthermore, it would have been obvious to one skilled in the art, when placing the radiation source and detecting means of Chiu into the apparatus of Satou's figure 7, to place it at the apex of the domed reactor because this location has the most available space between the coil windings.

Claims 8, 9, 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiu and Satou as applied to claims 1 and 21 above and further in view of U.S. Patent 5,691,540 issued to Halle et al. (hereinafter, Halle).

Chiu and Satou do not teach a bifurcated optical cable with one end being connected to the signal source and the other end being connected to the signal detector.

Halle teaches the a plasma process monitoring apparatus that includes a collimating lens and a bifurcated optical cable with end being connected to the signal source and one end being connected to the signal detector.

The above noted limitations that Chiu and Satou fail to teach is an apparatus limitation recited within method claims. Apparatus limitations, unless they affect the process in a manipulative sense, are afforded little weight in process claims[1]. Nevertheless, it would be obvious to one skilled in the art to incorporate the apparatus of Halle into the combined teachings of Chiu and Satou because Halle teaches that the assembly is compact and inexpensive and the design provides significant advantages, such as, providing the ability to measure the trench depth of features having a lateral dimension of less than 0.5 μm.

Response to Arguments

Applicant's arguments filed June 13, 2007 have been fully considered but they are not persuasive. The bulk of applicant's arguments pertain to the language added to many of the independent claims, specifically, "directing radiation onto the substrate surface from directly above the substrate and through the wall of the process chamber".

With respect to Chiu, applicant argues:

1) Chiu does not teach a coil that is above an external surface of the chamber and,

[1] *In re Tarczy-Hornoch* 158 USPQ 141, 150 (CCPA 1968); *In re Edwards* 128 USPQ 387 (CCPA 1961); *Stalego v. Heymes* 120 USPQ 473, 478 (CCPA 1959); *Ex parte Hart* 117 USPQ 193 (PO BdPatApp 1957); *In re Freeman* 44 USPQ 116 (CCPA 1940); *In re Sweeney* 72 USPQ 501 CCPA 1947).

2) Chiu does not teach directing radiation onto the substrate from "directly above the substrate"

Regarding the first argument, the examiner notes that Satou was relied upon for teaching the claimed coil configuration (see figures 5 and 7 of Satou). Furthermore, if one considers the base member of Chiu's chamber as constituting a chamber wall then Chiu does indeed teach a coil that is above an external surface a chamber wall.

Regarding the second argument, as noted above, Chiu teaches "the end of the **optical fiber 26 is positioned...typically above the surface of wafer (**column 5, lines 50-52, emphasis added). Regarding the claimed "**directly** above the substrate", for the reason stated in the above rejection the examiner considers this to be obvious from the combination of Chiu and Satou. Additionally, Chui and Satou are considered to teach this limitation. The examiner is required to apply the broadest reasonable interpretation to claim language. For the following reasons, the phrase "directly above" is broadly interpreted as meaning "above". The phrase "directly above" occurs but once in applicant's specification. The following single occurrence of this phrase is on page 10, lines 8-9 in a description of figure 3:

> The signal source 118 and signal detector 120 are
> ...disposed directly above the collimating assembly 126.

A detail of figure 3 is shown below to highlight that portion which is relevant to the above passage and the phrase "directly above".

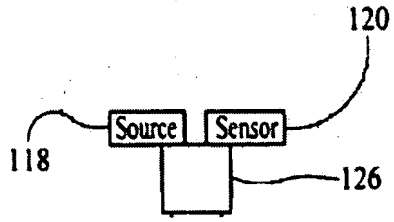

Figure 3 shows that "directly above" can be broadly interpreted. Furthermore, the following definitions from Merriam Webster's Collegiate Dictionary, 10th Edition, are of note.

> *direct*: from point to point without deviation;
>
> *directly*: in a direct manner;

and as the limitation pertains to directing radiation upon a substrate,

> *direct lighting*: lighting in which the greater part of the light goes directly from the source to the area lit.

To the extent that applicant maintains that "directly above" requires the radiation source be within the confines of the vertical projection of the substrate, the examiner again notes that the above rejection stated why it would have been obvious to place the radiation source and detecting means of Chiu at the apex of Satou's reactor. Furthermore, while it is not deemed necessary to rely upon another reference to address this aspect of the claimed invention, it is worth noting that there is an abundance of prior art, that is of record, in which radiation is directed upon a substrate from a position that corresponds to what applicant presumably intends by "directly above". For example: Coronel et al. (US 5,807,761); Dreyfus et al. (US 2,973,686); Halle et al. (US 5,691,540); Suzuki et al. (US 4,579,623); Saxena (US 5,472,508); van Os et al. (US 5,792,272); Moslehi (US 5,846,883); and Giapis et al. (US 5,002,631).

Additionally, with respect to "directly above", applicant argues:

> *Satou et al. cannot be combined to Chui to make obvious claim 1. Satou et al. does not make up for the deficiencies of Chiu et al. recited above, as the Examiner cites Satou et al. only to teach "ICP plasma reactors having the claimed coil configurations (see figures 5 and 7)." Satou et al. does not teach or suggest directing radiation onto the substrate surface from directly above the substrate and through the wall of the process chamber, detecting radiation reflected from the substrate, collimating the detected radiation, and evaluating the detected collimated radiation, as claimed. It is not clear why one of ordinary skill in the art would be motivated to modify the chamber taught by Chiu et al. to the different type of chamber taught by Satou et al.. Similarly, there is no teaching or suggestion that would motivate one of ordinary skill in the art to apply the process monitoring system taught by Chiu et al. to the type of chamber and external antenna system taught by Satou et al.. In fact, since Chiu et al. indicates that detecting radiation is a problem even when the antenna coil surrounds sidewalls of the chamber, one would be motivated against applying an antenna that is above the external surface of the chamber as this would further exacerbate the problem of monitoring the endpoint signal from directly above the substrate in the chamber, as claimed.*

The examiner fails to see how the combination of Chui and Satou would further exacerbate the problem of monitoring the endpoint signal. Chui teaches passing the optical fiber through the coils of the RF antennae and whatever problem this presents would be the same regardless of whether the optical fiber passes between a coil that is wrapped around the side-wall of the chamber or whether the optical fiber passes between a coil that is disposed over the chamber.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441. The examiner can normally be reached on M,W,F 12:30- 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Allan Olsen
Primary Examiner
Art Unit 1763